Space Weather Technical Forecast

Issued on Saturday, 30 July 2022 at 00:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Storm intervals days 1 and 2 (30th and 31st).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with an impulsive C4 flare at 29/0432UTC, originating from AR3068 in the southeast quadrant. There are currently four sunspot regions on the visible disc. AR3038 Dsi/Beta is the largest region, with intermediate spot growth in the last 24 hours. The other three regions are all small and simple. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR at L1, were predominantly at background levels, between 340-400 km/s. Density was mainly at average levels. The total interplanetary magnetic field (IMF), Bt, was mostly weak, below 8nT, with the north-south component, Bz, fluctuating between +6nT to -4nT. The Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16 was at Background levels. The High energy electron flux (greater than 2MeV) varied between Background and Moderate levels, with a brief peak of 759pfu observed at 29/1640 UTC. Electron fluence showed a declining trend, remaining well below the Active threshold (1e8 integrated flux), with an observed fluence of 2.06e7 integrated pfu recorded at 30/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Very Low solar activity is expected to continue, with only a slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: No CMEs have been assessed as Earth-directed. Background winds initially, before the arrival of the fast wind of CH04 day 1 (30th), perhaps into day 2 (31st). Solar winds likely gradually easing day 3 and 4 (1st and 2nd), but could see further enhancement from the southern coronal holes (CH06/CH07) by the end of the period. Geomagnetic activity is forecast to be mainly Quiet with a chance of Unsettled intervals, then Unsettled with Active intervals with a slight chance of G1/Minor storm with the arrival of the fast winds day 1, perhaps into day 2 (30th and 31st). Activity easing back to Quiet to Unsettled thereafter, but with a slight chance of increasing to Active to G1/Minor Storm by the end of the period.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at Background levels. The high energy electron flux (greater than 2 MeV) is expected to remain mostly at Background and Moderate levels, but with a chance of rising to give diurnal peaks of high as the fast wind of CH04 recedes day 3 onward (1st). The corresponding 24 hour fluence is forecast to remain below the Active threshold (1e8 integrated pfu).

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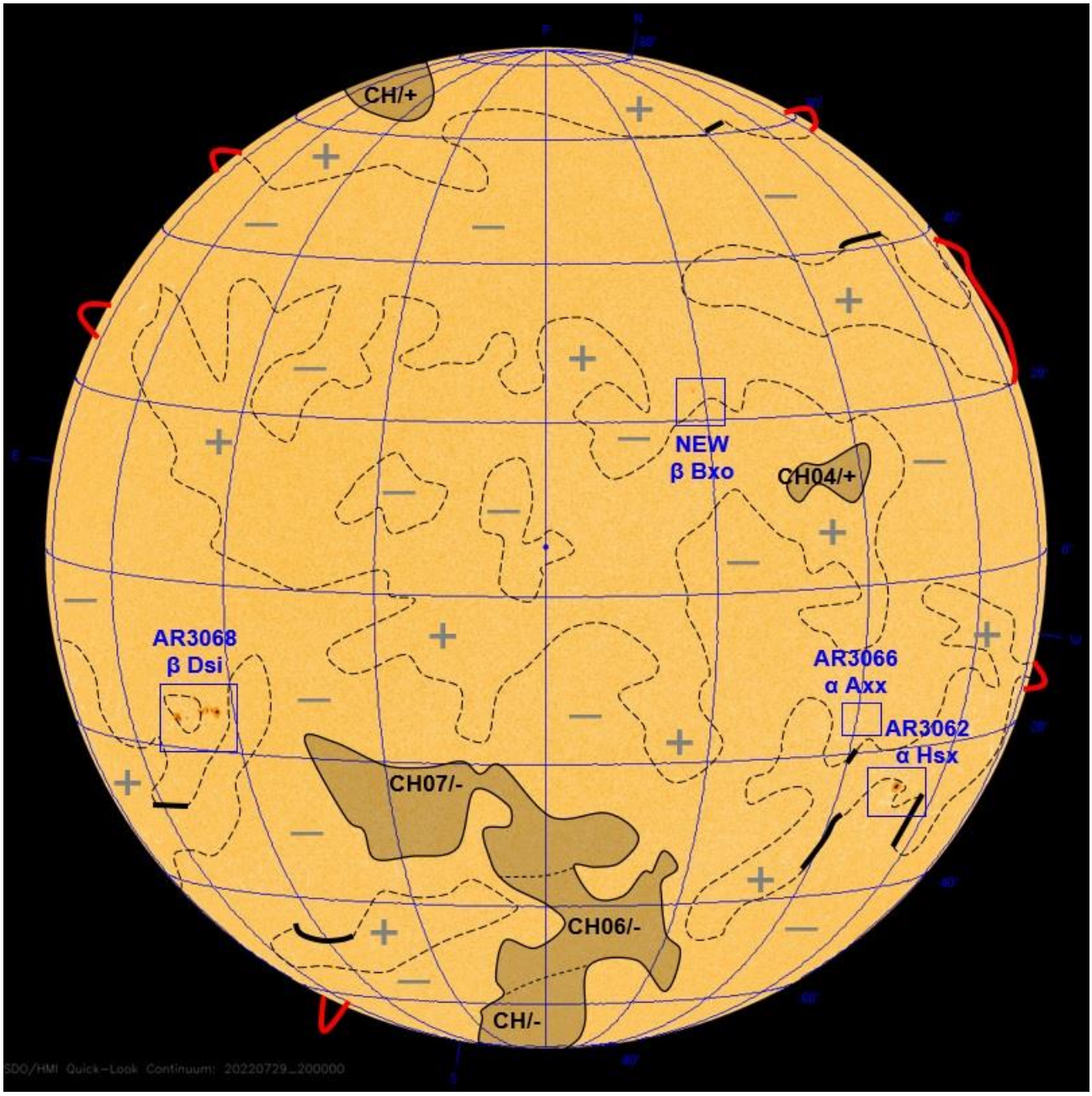
Figure 1. Solar Analysis Valid 29/2000 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs have been assessed as Earth-directed for this period.

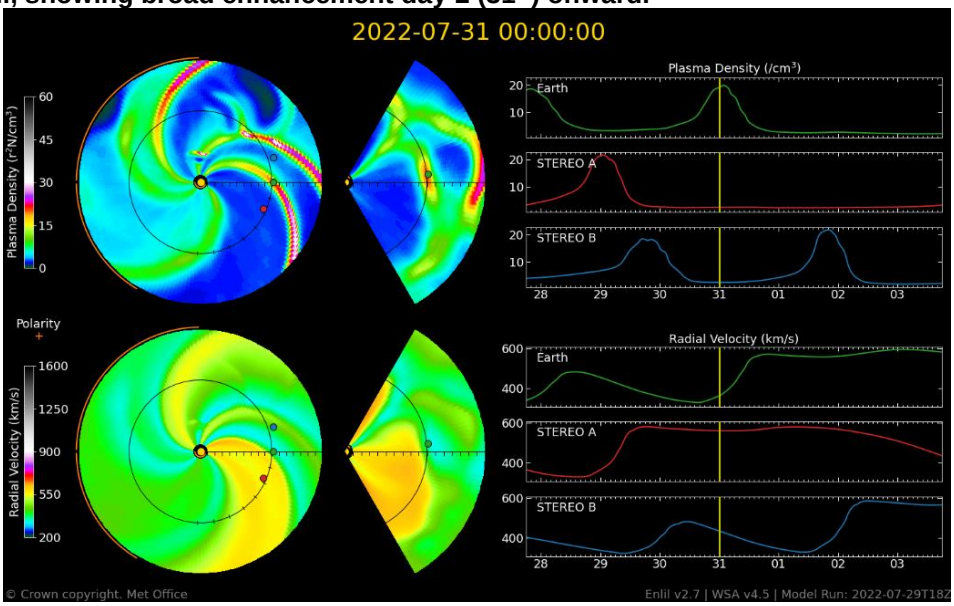
Solar winds have persisted at background, ahead of CH04/+ whose fast wind is expected to arrive later day 1 or potentially early day 2 (30th or early 31st). The initial arrival would correspond to a weak enhancement observed at STEREO A around 28/1400 UTC, as this spacecraft observes solar wind conditions around 1.9 days ahead of Earth. There is some uncertainty however, as a further enhancement has been observed around 29/1800 UTC.

This uncertainty is compounded by the lack of useful persistence data, and Enlil appearing to have an erroneous strong and broad enhancement early on the 31st whose source is uncertain. Some enhancement is possible later in the period from CH06/CH07, which are northward extensions of the southern polar crown. However with Earth north of the solar equatorial plane, any such enhancement is very low confidence.

Overall initially Quiet geomagnetic activity is likely to become Unsettled with Active intervals and a chance of G1/Minor Storms with the arrival of any fast wind of CH04. These conditions will ease to Quiet to Unsettled day 3 onward, but with a slight chance of Active to G1/Minor Storm intervals returning with any further enhancement.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	20	5	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Enlil, showing broad enhancement day 2 (31st) onward.



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Radio Blackouts - X-Ray Flares:

Solar activity is currently Low, with a C4-flare from AR3068 Dsi/Beta at 0433 UTC in the southeast disc. This is a relatively small region, but exhibited small growth in its intermediate spots in the last 24 hours. There are four sunspot regions on the disc, however AR3068 is the only region of note, with the other three much smaller and simpler.

Far-sided products do suggest the potential for further regions to rotate onto the Earth-facing disc through the period, with the next anticipated region being ex-AR3053, likely emerging from over the northeast limb on day 3 (1st).

Activity is expected to remain Low to Very Low, with only a slight chance of rising to Moderate from any M-flares, most likely from AR3068.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES 16/17 X-ray Flux

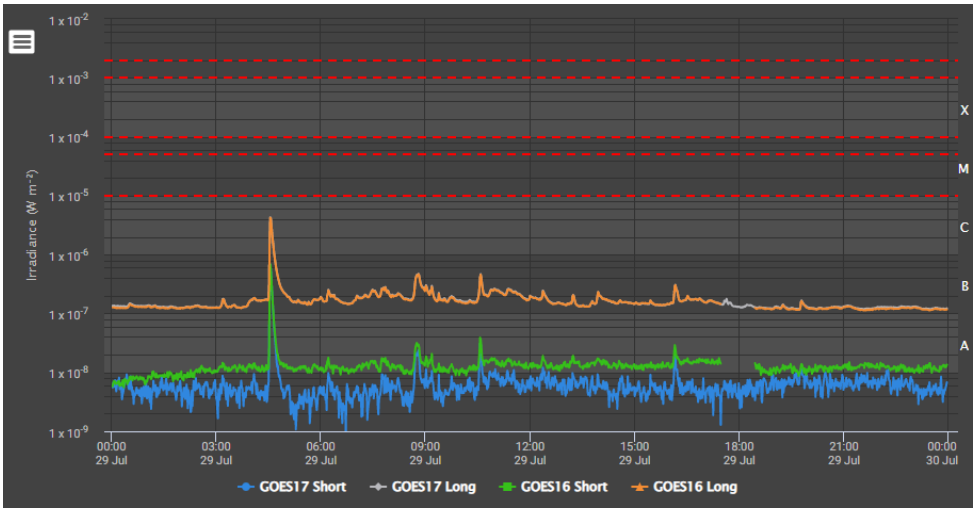

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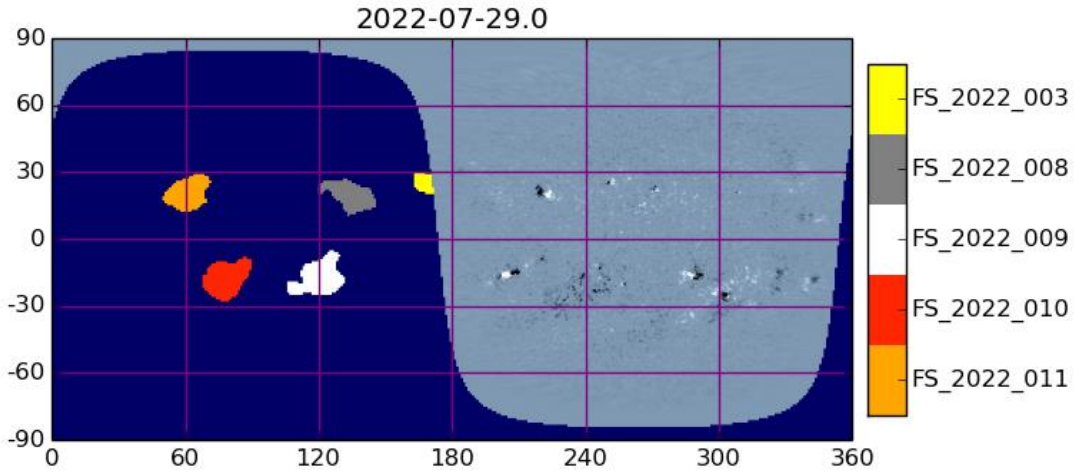
Figure 4: Helioseismic signature of potential far-side regions (from jsoc.stanford.edu)



Designation	Centroid Longitude (degree)	Centroid Latitude (degree)	Strength	ETA at East Limb (yyyy-mm-dd.d)	Days from East Limb
FS-2022-003	166.9	24.4	175	2022-07-29.3	0.3
FS-2022-008	133.8	19.0	1005	2022-07-31.9	2.9
FS-2022-009	119.9	-18.1	1227	2022-08-02.2	4.2
FS-2022-010	77.9	-18.0	1415	2022-08-05.4	7.4
FS-2022-011	60.8	19.7	1204	2022-08-06.4	8.4

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels and is currently expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) as measured by GOES-16 is expected to continue fluctuating between background and moderate levels. This is likely to increase in response to any enhancement, perhaps briefly reaching High levels on day 3 and 4 during diurnal max.

The corresponding 24-hour fluence is expected to remain below the Active (1e8 integrated pfu) threshold through the period, with any enhancement unlikely to bring sufficiently persistent High flux to breach the Active level. This is supported by the REFM output.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES-16 >2MeV Electron Flux (top) and Fluence with REFM and persistence (bottom)

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